

## FOD420, FOD4208, FOD4216, FOD4218 6-Pin DIP Triac Drivers

### Features

- 300mA on-state current
- High blocking voltage
  - 800V (FOD4208, FOD4218)
  - 600V (FOD420, FOD4216)
- High trigger sensitivity
  - 1.3mA (FOD4216, FOD4218)
  - 2mA (FOD420, FOD4208)
- High static dv/dt (10,000V/μs)
- 6 pin DIP dual in-line package
  - available with surface mount leadform.
- Lead free assembly
- UL, VDE, FIMKO and C-UL approved

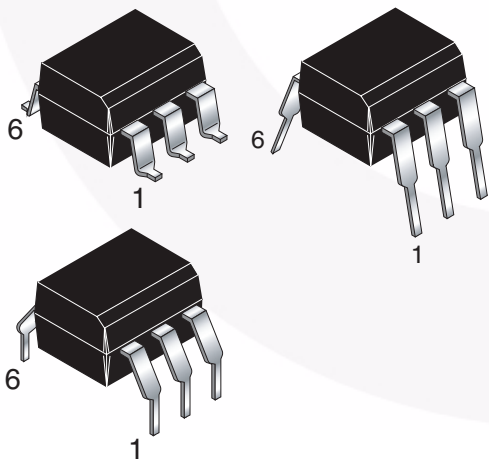
### Applications

- Solid-state relays
- Industrial controls
- Lighting controls
- Static power switches
- AC motor starters

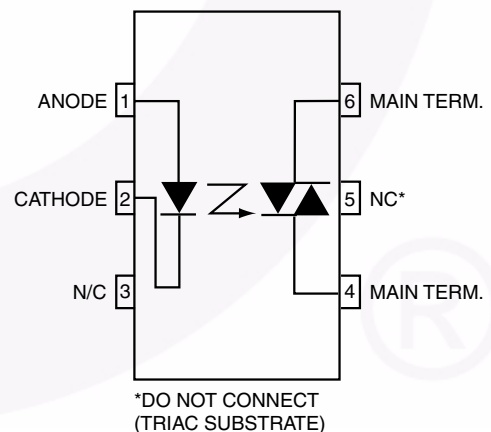
### Description

The FOD420, FOD4208, FOD4216 and FOD4218 devices consist of an infrared emitting diode coupled to a hybrid random phase triac formed with two inverse parallel SCRs which form the triac function capable of driving discrete triacs. The FOD4216 and FOD4218 utilize a high efficiency infrared emitting diode which offers an improved trigger sensitivity. These devices are housed in a standard 6-pin dual in-line (DIP) package.

### Package



### Schematic



**Absolute Maximum Ratings** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameters	Device	Value	Units
<b>TOTAL DEVICE</b>				
$T_{STG}$	Storage Temperature	All	-55 to +150	$^\circ\text{C}$
$T_{OPR}$	Operating Temperature	All	-55 to +100	$^\circ\text{C}$
$T_{SOL}$	Lead Solder Temperature (Wave)	All	260 for 10 sec	$^\circ\text{C}$
$T_J$	Junction Temperature Range	All	125	$^\circ\text{C}$
$V_{ISO}$	Isolation Test Voltage <sup>(1)</sup> (rms AC voltage, 60Hz, 1 min. duration)	All	5000	Vac(rms)
$P_{DTOTAL}$	Total Device Power Dissipation @ 25 $^\circ\text{C}$ Derate above 40 $^\circ\text{C}$	All	500	mW
			6.6	mW/ $^\circ\text{C}$
<b>EMITTER</b>				
$I_F$	Continuous Forward Current	All	30	mA
$V_R$	Reverse Voltage	All	6	V
$P_{DE}$	Total Power Dissipation 25 $^\circ\text{C}$ Ambient Derate above 40 $^\circ\text{C}$	All	50	mW
			0.71	mW/ $^\circ\text{C}$
<b>DETECTOR</b>				
$V_{DRM}$	Off-State Output Terminal Voltage	FOD420, FOD4216	600	V
		FOD4208, FOD4218	800	
$I_{TSM}$	Peak Non-Repetitive Surge Current (single cycle 60Hz sine wave)	All	3	A
$I_{TM}$	Peak On-State Current	All	300	mA
$P_{DDET}$	Total Power Dissipation @ 25 $^\circ\text{C}$ Ambient Derate above 40 $^\circ\text{C}$	All	450	mW
			5.9	mW/ $^\circ\text{C}$

**Note:**

1. Isolation voltage,  $V_{ISO}$ , is an internal device dielectric breakdown rating. For this test, Pins 1, 2 and 3 are common, and Pins 4, 5 and 6 are common. 5,000 VRMS for 1 minute duration is equivalent to 6,000 VRMS for 1 second duration.

**Electrical Characteristics** ( $T_A = 25^\circ\text{C}$  Unless otherwise specified)

**Individual Component Characteristics**

Symbol	Parameters	Test Conditions	Device	Min.	Typ.*	Max	Units
<b>EMITTER</b>							
$V_F$	Input Forward Voltage	$I_F = 20\text{mA}$	All		1.28	1.5	V
$I_R$	Reverse Leakage Current	$V_R = 6\text{V}$	All		0.01	10	$\mu\text{A}$
<b>DETECTOR</b>							
$I_{DRM}$	Peak Blocking Current, Either Direction	$I_F = 0,$ $T_A = 100^\circ\text{C}^{(2)}$	$V_D = 800\text{V}$	FOD4208, FOD4218	3	100	$\mu\text{A}$
			$V_D = 600\text{V}$	FOD420, FOD4216			
$I_{R(RMS)}$	Reverse Current	$T_A = 100^\circ\text{C}$	$V_D = 800\text{V}$	FOD4208, FOD4218	3	100	$\mu\text{A}$
			$V_D = 600\text{V}$	FOD420, FOD4216			
dv/dt	Critical Rate of Rise of Off-State Voltage	$I_F = 0^{(4)}$ (Fig. 11)		10,000			V/ $\mu\text{s}$

**Transfer Characteristics**

Symbol	DC Characteristics	Test Conditions	Device	Min.	Typ.*	Max.	Units
$I_{FT}$	LED Trigger Current	Main Terminal Voltage = $5\text{V}^{(3)}$	FOD420, FOD4208		0.75	2.0	mA
			FOD4216, FOD4218		0.75	1.3	
$V_{TM}$	Peak On-State Voltage, Either Direction	$I_{TM} = 300\text{ mA peak}, I_F = \text{rated } I_{FT}$	All		2.2	3	V
$I_H$	Holding Current, Either Direction	$V_T = 3\text{V}$	All		200	500	$\mu\text{A}$
$I_L$	Latching Current	$V_T = 2.2\text{V}$	All		5		mA
$t_{ON}$	Turn-On Time	PF = 1.0, $I_T = 300\text{mA}$	$V_{RM} = V_{DM} = 565\text{ VAC}$	FOD4208	60		$\mu\text{s}$
			$V_{RM} = V_{DM} = 424\text{ VAC}$	FOD420, FOD4216, FOD4218			
$t_{OFF}$	Turn-Off Time		$V_{RM} = V_{DM} = 565\text{ VAC}$	FOD4208	52		$\mu\text{s}$
			$V_{RM} = V_{DM} = 424\text{ VAC}$	FOD420, FOD4216, FOD4218			
dv/dt <sub>crq</sub>	Critical Rate of Rise of Voltage at Current Commutation	$V_D = 0.67 V_{DRM},$ $di/dt_{crq} \leq 15\text{ A/ms}$	$T_j = 25^\circ\text{C}$	All	10,000		V/ $\mu\text{s}$
			$T_j = 80^\circ\text{C}$		5,000		
di/dt <sub>cr</sub>	Critical Rate of Rise of On-State Current		All			8	A/ $\mu\text{s}$
dV(10)/dt	Critical Rate of Rise of Coupled Input/Output Voltage	$I_T = 0\text{A},$ $V_{RM} = V_{DM} = 424\text{VAC}$	All		10,000		V/ $\mu\text{s}$

**Isolation Characteristics**

Symbol	Characteristics	Test Conditions	Min.	Typ.*	Max.	Units
$V_{ISO}$	Input-Output Isolation Voltage	f = 60Hz, t = 1 min. <sup>(5)</sup>	5000			Vac(rms)

\*Typical values at  $T_A = 25^\circ\text{C}$

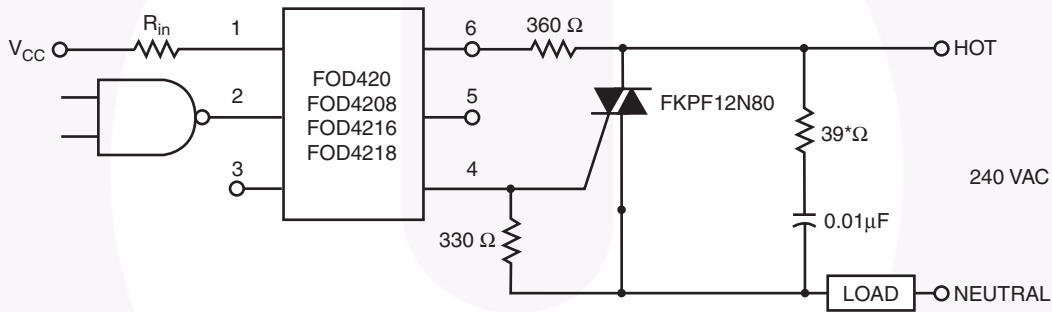
**Notes:**

2. Test voltage must be applied within dv/dt rating.
3. All devices are guaranteed to trigger at an  $I_F$  value less than or equal to  $\max I_{FT}$ . Therefore, recommended operating  $I_F$  lies between  $\max I_{FT}$  (2mA for FOD420 and FOD4208 and 1.3mA for FOD4216 and FOD4218 and the absolute  $\max I_F$  (30mA).
4. This is static dv/dt. See Figure 11 for test circuit. Commutating dv/dt is a function of the load-driving thyristor(s) only.
5. Isolation voltage,  $V_{ISO}$ , is an internal device dielectric breakdown rating. For this test, Pins 1, 2 and 3 are common, and Pins 4, 5 and 6 are common.

**Typical Application**

Typical circuit for use when hot line switching is required. In this circuit the "hot" side of the line is switched and the load connected to the cold or neutral side. The load may be connected to either the neutral or hot line.

$R_{in}$  is calculated so that  $I_F$  is equal to the rated  $I_{FT}$  of the part, 2mA for FOD420 and FOD4208, 1.3mA for FOD4216 and FOD4218. The 39Ω resistor and 0.01μF capacitor are for snubbing of the triac and may or may not be necessary depending upon the particular triac and load use.

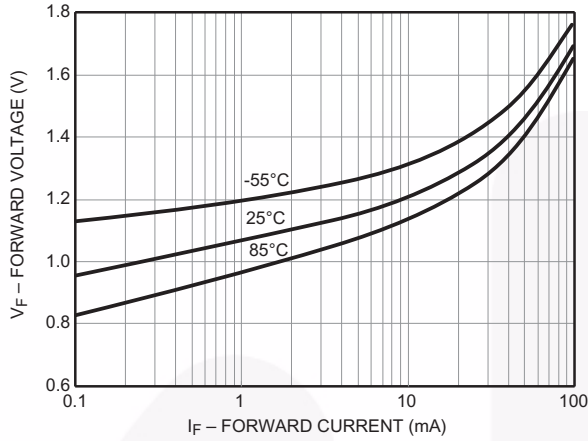


\* For highly inductive loads (power factor < 0.5), change this value to 360 ohms.

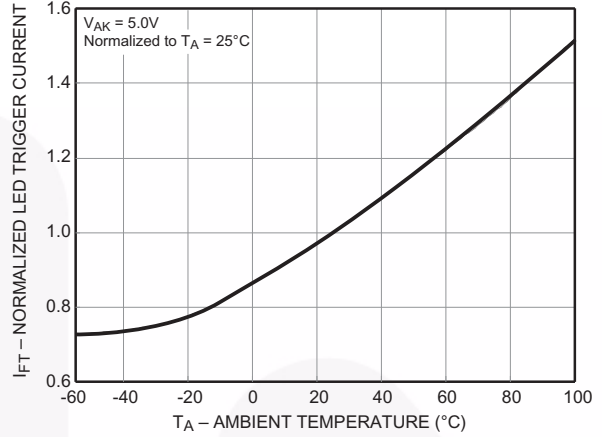
**Figure 1. Hot-Line Switching Application Circuit**

## Typical Performance Curves

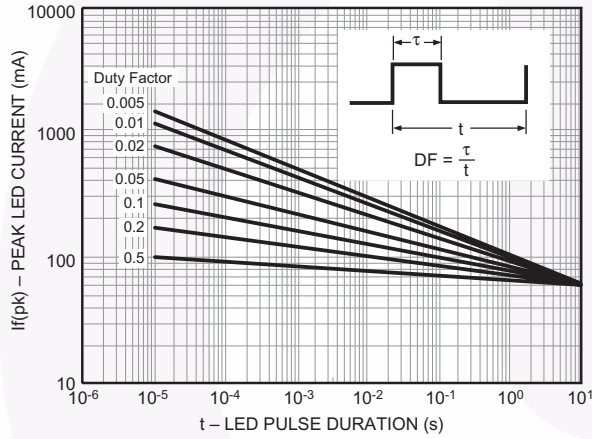
**Figure 2. Forward Voltage ( $V_F$ ) vs. Forward Current ( $I_F$ )**



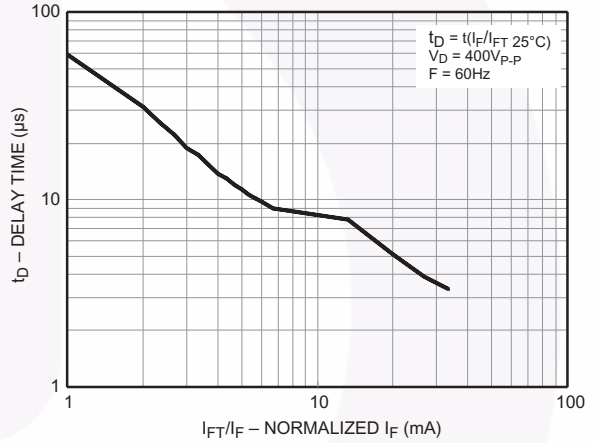
**Figure 3. Normalized LED Trigger Current ( $I_{FT}$ ) vs. Ambient Temperature ( $T_A$ )**



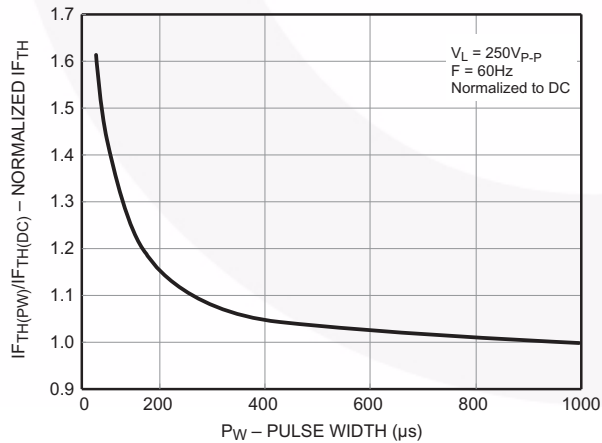
**Figure 4. Peak LED Current vs. Duty Factor, Tau**



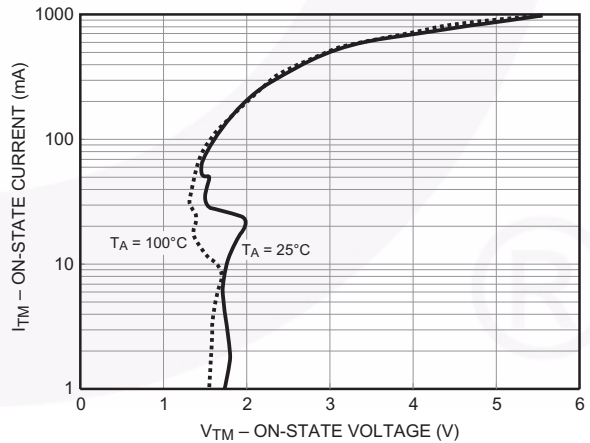
**Figure 5. Trigger Delay Time**



**Figure 6. Pulse Trigger Current**



**Figure 7. On-State Voltage ( $V_{TM}$ ) vs. On-State Current ( $I_{TM}$ )**



Typical Performance Curves (Continued)

Figure 8. Normalized Holding Current ( $I_H$ ) vs. Ambient Temperature ( $T_A$ )

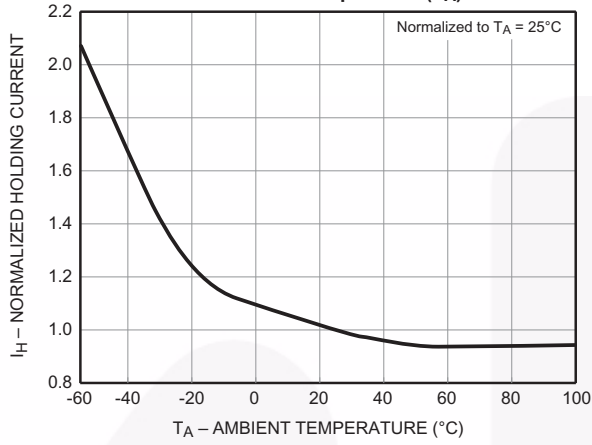


Figure 9. Normalized Off-State Current ( $I_{DRM}$ ) vs. Ambient Temperature ( $T_A$ )

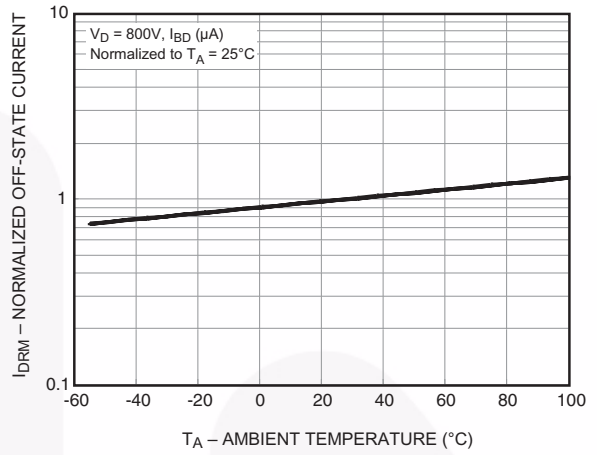
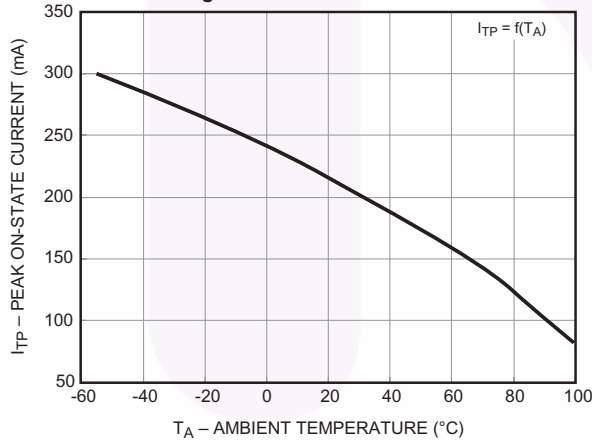
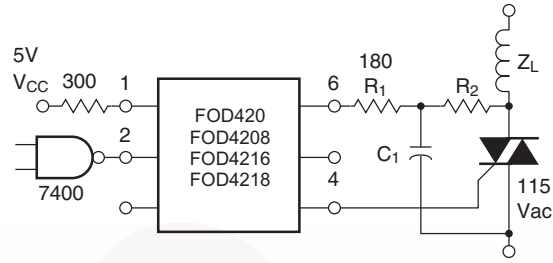


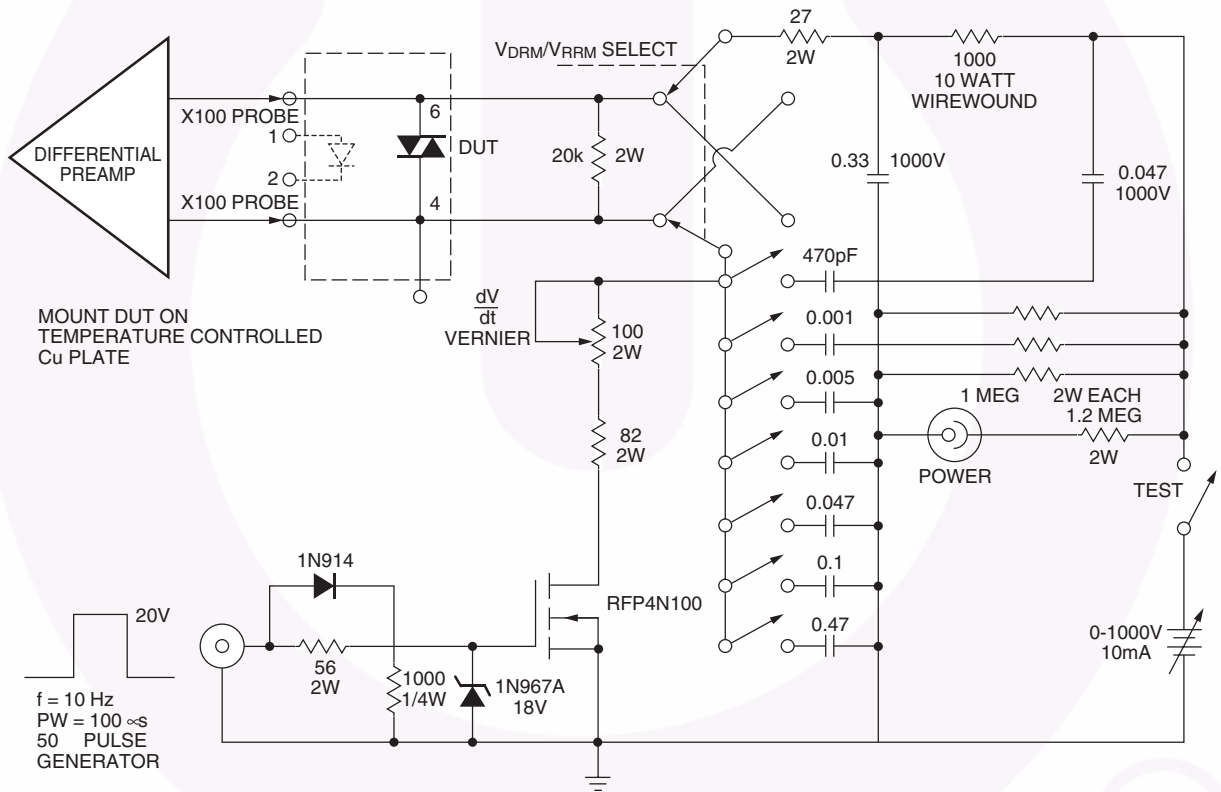
Figure 10. Current Reduction





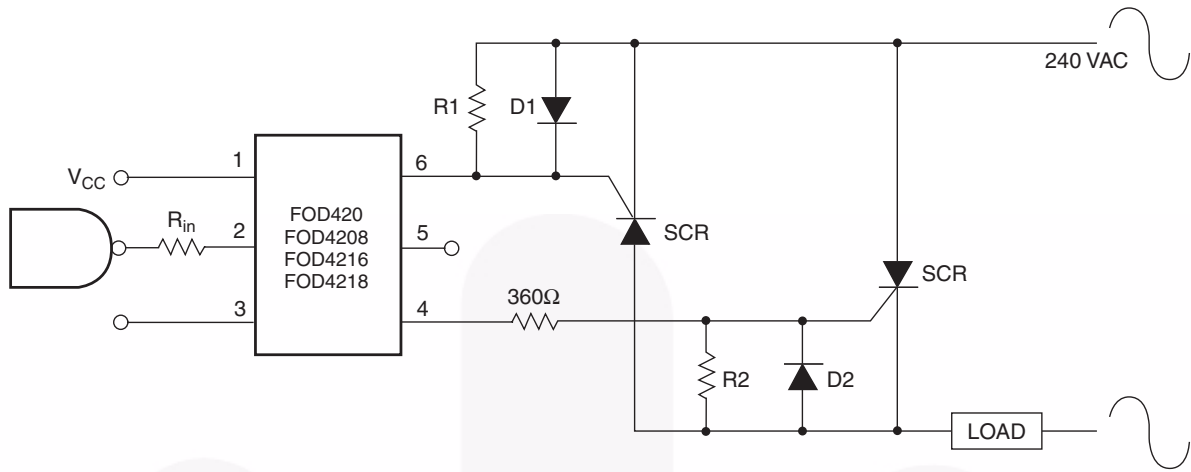
NOTE: Circuit supplies 25mA drive to gate of triac at  $V_{in} = 25V$  and  $T_A < 70^\circ C$

TRIAC		
$I_{GT}$	$R_2$	C
15 mA	2400	0.1
30 mA	1200	0.2
50 mA	800	0.3



ALL COMPONENTS ARE NON-INDUCTIVE UNLESS SHOWN

Figure 11. Circuit for Static  $\frac{dV}{dt}$  Measurement of Power Thyristors



**Figure 12. Inverse-Parallel SCR Driver Circuit**

Suggested method of firing two, back-to-back SCR's with a Fairchild triac driver. Diodes can be 1N4001; resistors, R1 and R2, are optional 330Ω.

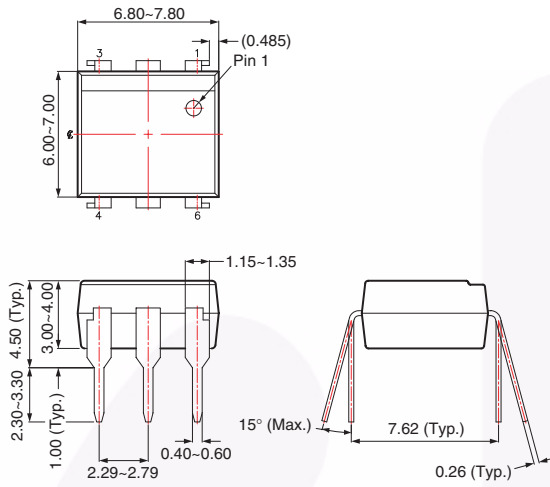
Note: This optoisolator should not be used to drive a load directly. It is intended to be a discrete triac driver device only.



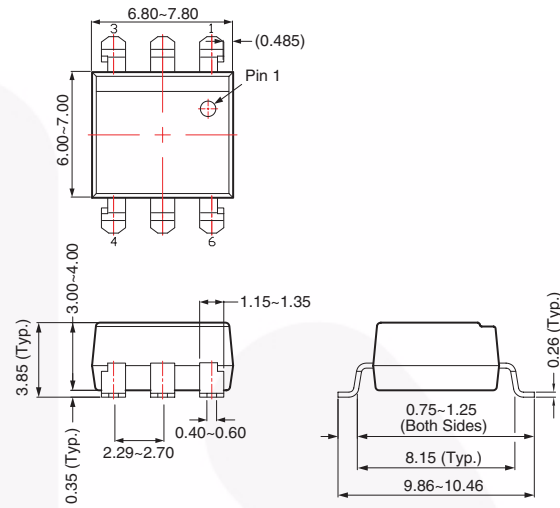


## Package Dimensions

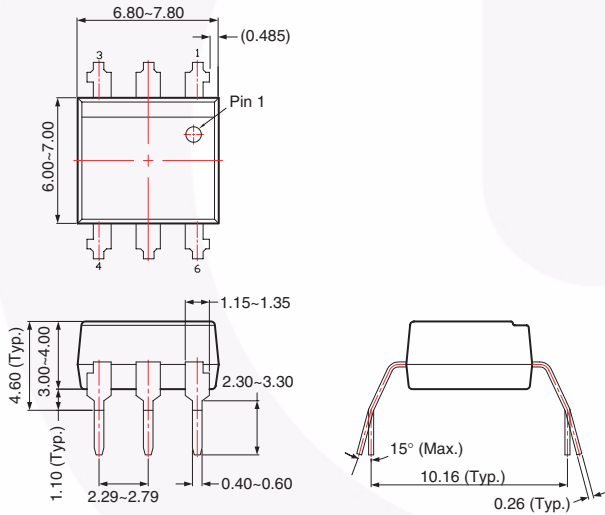
### Through Hole



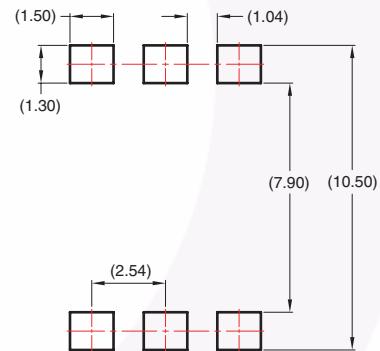
### Surface Mount



### 0.4" Lead Spacing



### Recommended Pad Layout for Surface Mount Leadforms



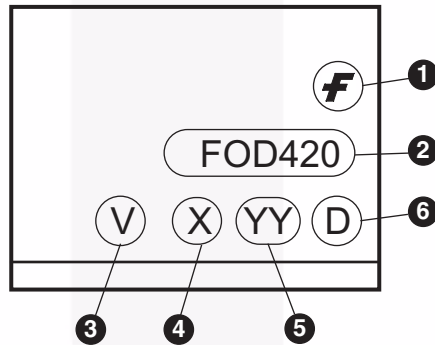
**Note:**

All dimensions are in millimeters.

## Ordering Information

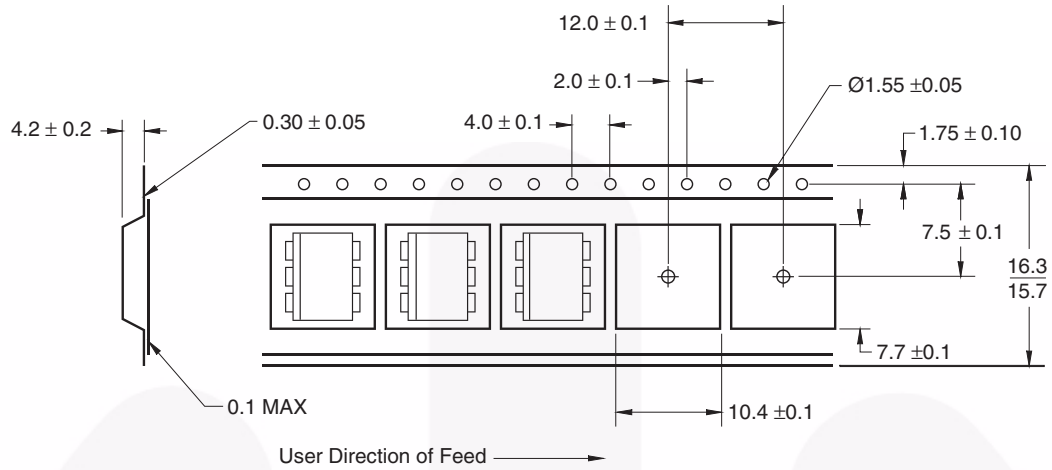
Option	Order Entry Identifier (example)	Description
None	FOD420	Standard Through Hole Device
S	FOD420S	Surface Mount Lead Bend
SD	FOD420SD	Surface Mount; Tape and reel
T	FOD420T	0.4" Lead Spacing
V	FOD420V	IEC60747-5-2 certification
TV	FOD420TV	IEC60747-5-2 certification, 0.4" Lead Spacing
SV	FOD420SV	IEC60747-5-2 certification, Surface Mount
SDV	FOD420SDV	IEC60747-5-2 certification, Surface Mount, Tape & Reel

## Marking Information



Definitions	
1	Fairchild logo
2	Device number
3	VDE mark indicates IEC60747-5-2 certified (Note: Only appears on parts ordered with VDE option – See order entry table)
4	One digit year code, e.g., '7'
5	Two digit work week ranging from '01' to '53'
6	Assembly package code

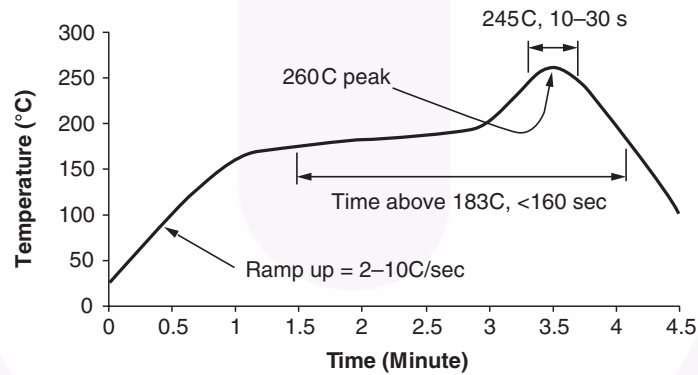
## Carrier Tape Specifications



### Note:

All dimensions are in inches (millimeters).

## Reflow Profile






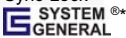


- Peak reflow temperature:  $260\text{C}$  (package surface temperature)
- Time of temperature higher than  $183\text{C}$  for 160 seconds or less
- One time soldering reflow is recommended



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**Definition of Terms**

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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